IMPACT OF INFLATION ON KENYA’S ECONOMIC GROWTH

BY

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A RESEARCH REPORT SUBMITTED TO THE COLLEGE OF BUSINESS AND MANAGEMENT SCIENCES IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF A MASTERS OF ARTS ECONOMIC POLICY MANAGEMENT DEGREE OF MAKERERE UNIVERSITY
DECLARATION

I Zala J. Pinky declare that this research paper is my own original work and has not been submitted to any other University or institution of higher learning for the award of a similar degree.


ZALA J. PINKY
APPROVAL

This research report has been submitted with my approval as the University Supervisor.

Signature ........................................ Date ........................................

Dr. BRUNO L. YAWE
DEDICATION

I dedicate this research report to my Husband; David K. Ndirangu our Daughter; Ariana W. Ndirangu and my Mother; Florence M. Wanjiku.
ACKNOWLEDGEMENT

I give gratitude to the almighty God for giving me life and strength to undertake the Master of Arts (Economic Policy Management) program. My enthusiasm to undertake this study at masters’ level was driven by various institutions and individuals who played a great role in giving me the morale to go on. Thanks to my lecturers at Makerere University for the elaborate lectures, moral and material support on my course work. Profound gratitude goes to Dr. Bruno L. Yawe for his guidance and corrections which led to the fine tuning of this document. May God reward him for the selfless guidance.

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<td>ADF</td>
<td>Augmented Dickey Fuller</td>
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<td>COBAMS</td>
<td>College of Business and Management Science</td>
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<td>EIU</td>
<td>Economic Intelligence Unit</td>
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<td>ECM</td>
<td>Error Correction Model</td>
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<td>EPM</td>
<td>Economic Policy Management</td>
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<td>GDP</td>
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<td>HIPC</td>
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ABSTRACT

This study investigated the impact of inflation on economic growth of Kenya. It was motivated by the constant rise in inflation which is also accompanied by a decline in economic growth of Kenya. Using time series data for the years 1985 to 2016, the study employed the Augmented Dickey Fuller ADF test for unit root co-integration analysis and Vector error correction model and ordinary Least Square Method (OLS). The empirical evidence from the (ADF) test for unit root reveals not all the variables were stationary in levels except Gross Domestic Product (GDP), Inflation (INF) and Real Interest Rate (RIR). However, Money Supply (M2) and Exchange Rate (EXR) became stationary after first differencing. The co integration shows that there is a significant long run relationship between Inflation and Economic growth; the Vector error correction Model (VECM) results shows adjustment toward equilibrium by 16% within a year. The OLS results show that Inflation (INF) and Broad Money (M2) increases Economic Growth while Interest Rate (RIR) and Exchange Rate (EXR) negatively affects economic growth Economic Growth (GDP). The above result shows that inflation is a serious macroeconomic problem in the Kenyan economy. This study therefore recommends that government should put in place strong fiscal policies that will regulate inflation and other macroeconomic variables like interest rate and exchange rate has they may in turn negatively affect economic growth.

Key Words: Inflation and Economic growth
CHAPTER ONE

INTRODUCTION

1.1 Background to the study

World economic growth and inflation rates have been fluctuating over the past decades and similarly inflation rates have been dominating to compare with growth rates in virtually many years Kasidi and Mwakanemela (2013). Inflation is defined as a state in the economy of a country, when there is an incessant rise in the price of goods as well as services over a period of time; and they believe that when the general price level rises Kasidi (2010). Its results is that each unit of currency buys fewer goods and services reflecting erosion in the purchasing power of capital and subsequently a loss of real value in the internal medium of exchange and unit of account in the economy (Kimani and Mutuku, 2013).

Studies also show that the effects of inflation on the economy are diverse and can be both positive and negative. But according to Kimani and Mutuku (2013) the negative effects are however most pronounced and comprise a decrease in the real value of money as well as other monetary variables over time. According to Wambui (2013) inflation imposes negative externalities on the economy when it interferes with the economy’s efficiency. Other studies like Chege (2012) explained that it may also reduce a country’s international competitiveness, by making its exports relatively more expensive than its imports thus impacting on the balance of payments.

Financial theorists Miller (1998) believe that there are direct and indirect aftermaths of inflation in every sector of the economy ranging from exchange rates, investment, unemployment, trade and interest rates, and among others. This has made the question of whether or not inflation is harmful to economic growth become a subject of intense debate to
policy makers and macro economist world over in the recent times Kasidi and Mwakanemela (2013). The relationship between inflation and the economic growth has continued to be one of the most common macroeconomic problems. And it is clear that a highly inflationary environment therefore adversely affects very many economic factors like the prices of stocks and the exchange rate. For instance, when inflation escalates interest rates also increase forcing the creditors to hike their lending rates. This eventually, plays a significant role in obstructing accessibility to funds for investment purposes eventually negating the prosperity and growth of the economy (Kimani and Mutuku, 2013).

The Kenyan economy has in the past decade been faced with a very high level of inflation rate volatility. For instance, in the year 2011 the Kenyan economy was characterized by high inflation rates and the Kenyan currency depreciated in a big way, with the inflation target set at 5% but averaged between 12.9% in January to 19.7% in November 2011 and this situation was attributed to high food prices, non-alcoholic beverages prices and transport charges Kirimi W (2014). Therefore to regulate the inflationary condition the central bank had to increase the Central Bank rates from 6% in January 2011 to 18% in December 2011 African (Economic Outlook, 2012).

Nevertheless by the first quarter of 2013 the economic environment showed persistent high inflation rates that reduced disposable incomes. This resulted into a reduction in savings levels thus fewer funds that could be used for investment Mugwe and Mungai (2013). “Inflation has continued to increasing at a very fast pace for instance; in June inflation increased from 4.05 per cent to 4.91 per cent. However the signs shows that inflation is rising, but with all indicators showing that inflation moving to the target of five per cent,” Ndungu (2013) business executives further emphasized that Kenya’s inflation could rise further in 2013. This may erode the purchasing power of struggling households and pile pressure on a resurging economy, even as they forecast a positive growth outlook. This came
to pass because comparatively, inflation stood at an average of 9.5 per cent during the year, wiping out all gains from the 4.7 per cent increase in nominal earnings and leaving workers in the negative territory (Mugwe and Mungai, 2013).

Despite the volatility of inflation rate, Kenya’s economy remained resilient through a turbulent 2014 and 2015 characterized by currency instability and monetary tightening to post an economic growth of 5.6% in 2015 from 5.3% in 2013 Economic Outlook (2016). The same report also showed a reduction in overall inflation to 5.3% in April 2016 from 7.1% in April 2015 due to lower food prices and reduced motoring expenses caused by low fuel price (Economic Outlook, 2016).

According to the Economic Intelligence Unit (2016), investment in infrastructure, strong household consumption, closer integration with EAC and recovery in tourism numbers led to the increase in the country’s GDP from 5.6% in 2015 to 5.8% in 2016. The Economic Intelligence Unit (EIU) is also expecting the country’s GDP growth to decline to 5.5% in 2017 largely due to a slowdown in investments as the country heads towards the general elections. Moves like the reduced lending to the private sector, the enactment of the Banking (Amendment) Act that caps lending rates, will also contribute to a decline in GDP (Ndungu, 2013).

However the Business Monitor Intelligence (BMI) believes that private consumption has driven the country’s economic growth forward, even when there are speculations of decline in GDP. In relation to this the Kenya National Bureau of Statistics (KNBS) reported that inflation increased from 7.0% in January 2017 to 9.0% in February 2017 on account of rising food and electricity prices. Inflation averaged 6.3% in 2016 due to subdued oil prices, lower electricity tariffs (due to increased reliance on geothermal power) and low food prices due to
improved rainfall. By the end of the first quota of 2017 Kenya’s inflation short at a rate of 5 year high 11.7 and in May inflation jumped to 11.70 percent accelerating from 11.48 percent increase in April and this inflation rate has remained the highest since 2012 (Kenya National Bureau of Statistics, 2017). And finally the Economic Outlook (2017) EIU has forecasts inflation to average 5.1% between 2017 and 2020 due to prudent monetary policy and efficiency gains arising from regulatory reform and investment in infrastructure.

1.2 Research Problem statement

Many authors have studied the relationship between inflation and economic growth using different approaches and varying results i.e. Yabus and Kessy (2015), Kimani and Mutuku (2013) found negative relationship between inflation and economic growth while Tadele (2014) found both a negative and positive result for both Ethiopia and Uganda respectively. Wambui (2013) and Wanjiku (2005) found a positive relationship in Kenya. From this it is therefore clearly seen that relationship between inflation and economic growth remains a controversial one in both theory and empirical literature (Wanjiku, 2005). And finally the current rise of inflation in the Kenyan economy from 11.48% to 11.70% accompanied by the decline in GDP from 6.1% to 4.7% in the first quarter of 2017 Kenya National Bureau of Statistics (2017) is alarming. This makes it argent to study the relationship between inflation and economic growth in Kenya so as to address the current inflation crisis.

1.3 Objectives of the study

In general this study aimed to investigate the impact of inflation on economic growth in Kenya. Specifically, the study aimed at:

i. Measuring the degree of responsiveness of Kenya’s economic Growth rate to changes in the general price levels (Inflation rate).
1.4 Research Hypotheses

Ho: inflation has no significant impact on economic growth rate of Kenya.

Ho: the economic growth in Kenya is not responsive to inflation growth rate.

1.5 Scope of the study

The study focused on the impact of inflation on economic growth in Kenya for the period extending from 1985 to 2016. The study has analyzed the annual data on Gross Domestic Product (GDP), Inflation (INF) Exchange Rates (EXR) and Interest Rate (IR) and Money Supply (M2).

1.6 Rationale and Justification of the study

The study was motivated by the fact that inflation seem to be having a great impact on economic growth and that there also seems to be a relationship between inflation and economic growth in Kenya. However, the level of impact and the nature of the relationship is not clear hence the need for a detailed empirical analysis. This study is imperative because it will add evidence a propos the controversy of the nature of the relationship between inflation and economic growth as well as help the scholars interested in this field of study. Additionally an investigation on this matter is indispensable since these two variables are some of the major and most common macroeconomic variables that can be used as a parameter to measure the economic progress of a country. The results of this study will benefit the policymakers and academic researchers in understanding the degree of responsiveness of GDP to inflation and thus come up with the relevant policies so as to regulate the inflation rate thus resulting into a stable macroeconomic environment and at the same time stimulate production which is aimed at enhancing economic growth.
1.7 Organization of the Study

Chapter one is the introduction of the study it presents the background of the study, the problem statement, study objectives and the research hypothesis, scope of the study and rational for the study. Chapter two discusses the literature in relation to the study topic it includes theoretical and empirical literature, an overview of the literature review is also provided in this chapter. The research methodology is discussed in chapter three which includes the econometric models used to perform test in this study while chapter four presents the data analysis, while summary, policy implications, recommendations and conclusions are given in chapter five.
CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter of the study presents both the theoretical and empirical literature on the impact of inflation on economic growth as well as the relationship between inflation and economic growth.

2.2 Theories of inflation

There are four major theories that try to link the relationship between inflation and economic growth and they include the Structuralists theory, the Keynesian theory, the monetarists theory and the cost push theory of inflation and are discussed below.

a) The Structuralists View

The Structuralists view was developed in the 1950s. According to them the starting point for the process of inflation is with internal changes in the structure of demand Compos (1963), they argue that if the demand for the output of particular sectors was increased, due to changes in the consumer tastes, the prices of goods produced in this sector will rise as a result of the increase in the demand for intermediate goods and raw materials, which enter in the production process of these industries. Thus, in the end, the average level of price and wages will necessarily rise.

b) Keynesian theory of inflation

This was developed by Keynes (1958) who argued that inflation is based on the fluctuations in aggregate supply and effective demand. They argue that if investment increases, it results in an increase in effective demand and not an increase in prices. However, there will be an increase in production until full employment is reached. Beyond this level of full
employment, any increase in aggregate demand in terms of money will cause prices to rise and hence inflation will occur.

According to this theory, the presence of under-employment and increase in money supply leads to an increase in aggregate demand which results into increase in output and employment in the economy. However this is only good if they increase is proportionate since continuous increase in money supply, aggregate demand, output and employment leads to diminishing returns start and certain bottlenecks (semi-inflation) and this process continues until full employment level is reached. In 1958, Keynes studied the statistical relationship between unemployment and the rate of change of money wage rate. And found that high inflation causes low rates of unemployment, therefore affects growth positively. However Friedman (1968) and Phelps (1967) argued that the idea that nominal variables, for example money supply or inflation, could permanently affect real variables, such as, output or unemployment, was unreasonable. In the long run, real forces determine the behavior of real variables.

c) Monetarist theory of inflation

The monetarist theory was developed by Friedman (1970) with an argument that inflation was a monetary phenomenon and was produced by rapid increase in the quantity of money. The monetarists asserts that changes in the money supply are more closely related to the changes in output and employment than to the changes in investment and government expenditure, which in the Keynesian approach are the main factors behind the fluctuations or changes in both output and employment. They state that as long as the demand for money is stable, the supply of money is considered as the main determinant of the price level or the key policy tool for controlling the income level. They further argued that if money supply per unit of output increases with prices remaining stable, people will feel that their cash balances are larger than required, thus raising the public's demand for goods and services and therefore
prices will increase Friedman (1970) summarized the inconclusive nature of the relationship between inflation and growth by saying that all possible combinations have occurred that is, inflation with and without growth, no inflation with and without growth.

d) The Cost-Push theory of inflation

The basic cause of cost-push inflation is the rise in money wages more rapidly than the productivity of labor. In advanced countries, trade unions press employers to grant wage increase considerably in excess of increases in productivity of labor, thereby raising the cost of producing commodities; which in turn make producers to raise prices of their products. Other sectors in the economy may be affected by money wage increases and their product prices may be rising Batten (1981). In most cases, their products are used as inputs for the production of commodities in other sectors. As a result, production costs of other sectors will rise and thereby push up the prices of their products. Further, an increase in the prices of domestically produced or imported raw materials may lead to cost push inflation since raw materials are used as inputs by the manufacturers of finished goods Batten (1981). However he concluded that though the cost-push argument is appealing, on the surface neither economic theory nor empirical evidence indicates that business and labour can cause continually rising prices.

2.3 Methodological literature

There are numerous approaches that can be used to model inflation and economic growth and some of them include; the ordinary least square method, the vector error correction model, the granger causality test, the vector auto regressive method among others. The purpose of this subsection is to examine the existing methodologies so as to assess the state of this research’s model from the standpoint of the models that others have used. This is therefore done by examining the research design, number of hypothesis testing, research methods, data analysis techniques and level of analysis.
Yabus and Kessy (2015) used a non-linear quadratic model on a panel data set for the period 1970 to 2013 to estimate the threshold level beyond which inflation exerts a negative impact on economic growth they included other moderating variables in the model. Tadele (2014) employed annual time series data which covered the period 1990-2012. He then adopted a descriptive approach to show the trend and variability of inflation and growth which is not what Yabus and Kessy (2015) used and then Vector Error Correction Model. Kirimi (2014) used ordinary least squares for estimation of time series data covering the period 1970-2013. Kasidi (2010) employed the Correlation coefficient and co-integration technique established the relationship between inflation and GDP and coefficient of elasticity were applied to measure the degree of responsiveness of change in GDP to changes in general price levels. Kasidi and Mwakanemela (2013) performed a disaggregated time series focused on a period of 20 years the study used secondary data and analyzed using excel spreadsheets this is a totally different method from what all the other authors used.

Kabundi (2012) used monthly data from January 1999 to October 2011 then applied a single-equation Error Correction Model (ECM) based on the quantity theory of money this is also different from what the rest of the other researchers did. Rutayisire (2013) used quadratic regression model and ordinary least square technique and performed a Granger causality test using time series data set spanning the sample period 1968-2010. Wanjiku (2005) used annual data covering the period 1963 to 2003 then applied the Phillips curve approach. The study also performed a unit root test, Granger causality tests and they finally performed Estimations using OLS estimation technique. And finally Gokal & Hanif (2004) used the data set of 140 countries and covered the period 1960-98; and employed the non-linear least squares (NLLS) method to estimate the relationship between inflation and economic growth in Fiji.
From the above review it is clear that both quantitative and qualitative research methods, empirical analysis and conceptual models were used. The gaps identified in the review were (a) the research at a national level particularly in Kenya was very limited, (b) econometric models are used in all the articles but most of them used consumer price index as a proxy for inflation.

### 2.4 Empirical Literature on Inflation and Growth

The above theories present a number of theoretical controversy on the relationship between inflation and growth yet several empirical studies have been carried out to investigate the relationship between inflation and economic growth. This section presents finding of other researcher who investigated the relationship between inflation and economic growth and other studies related to this topic of study.

Yabus and Kessy (2015) empirically estimated threshold level of inflation, which is conducive for economic growth in the three founding EAC countries, Kenya, Tanzania and Uganda. They found that credit to GDP ratio, degree of openness of the economy and foreign direct investment flows to EAC member states have significant and positive impact on growth. In determining threshold level of inflation for the three EAC member states, regression results of the random effect model establish that the average rate of inflation beyond 8.46 percent has a negative and significant impact on economic growth. For individual countries, findings from the Seemingly Unrelated Regression (SUR), which treats each country separately, indicate that the optimal levels of inflation for Kenya, Tanzania and Uganda are, 6.77 percent, 8.80 percent and 8.41 percent, respectively, beyond which inflation starts exerting cost on economic growth. The implication for monetary policy is that policy makers in the EAC member countries need to continue putting effort in achieving and maintaining single-digit level of inflation to support economic growth.
Tadele (2014) studied inflation and growth relationships: a comparative study of Ethiopia and Uganda and found a co-integration between the variables. Comparison of the coefficient of variations of the two countries shows that the variability’s of GDP and inflation are larger for Ethiopia than Uganda. The Vector Error Correction Model shows the existence of a positive significant bi-directional feedback relationship between inflation and economic growth for Ethiopia both in the short and long run. But for Uganda there exists only a uni-directional negative relationship between inflation and growth that runs from GDP growth to inflation. The study recommended that since there is a strong long run effect of economic growth on inflation both in Ethiopia and Uganda, there is a need for a stabilization program to mitigate the inflationary situations in both countries. And focus should be given on policies that will achieve price stability in Ethiopia. As Uganda needs to concentrate on the adoption of a more appropriate fiscal policy instruments like increasing the provision of infrastructural facilities, provision of professional training for farmers, increment of investment opportunities and the likes that could eliminate the structural bottlenecks.

Kirimi (2014) in the paper the determinants of inflation in Kenya sought to establish the main determinants of inflation in Kenya The study’s finding revealed that there was a negative relationship between food price and inflation level, Central bank rates was found to be statistically significant at 5% level of significance in causing the variation in inflation rate. Money supply (M2) and exchange rate had a positive relationship with the inflation rate while GDP growth rate and the corruption perception had a negative relationship with inflation. Wage rate coefficient was found insignificant in causing the changes in inflation with political instability having no effect on inflation. The study recommended that the government and policy makers should put in place policies that will ensure price stability.
Kasidi and Mwakanemela (2013) studied the impact of inflation on economic growth in Tanzania. The Correlation and Coefficient of elasticity were applied to measure the degree of responsiveness of change in GDP to changes in general price levels. Results suggest that inflation has a negative impact on economic growth and that there was no co-integration between inflation and economic growth during the period of study. No long-run relationship between inflation and economic growth in Tanzania.

Wambui (2013) studied the effects of government expenditure, taxes and inflation on economic growth in Kenya. The study performed a disaggregated time series analysis and that there is a linear relationship between each of the independent variables and the dependent variable. Further the study showed that the relationship is not only linear but also positively linear. Multiple correlations of the independent showed that taxes and government expenditure increase the level of GDP of Kenya. The results also showed that different levels of inflation affect GDP in different ways that is; some levels of inflation increase GDP whereas some levels of inflation decrease GDP. They made a conclusion that there is a linear relationship between taxes, inflation, government expenditure and economic growth and recommended that the policy makers should ensure optimal combination of taxes, inflation, and expenditure that achieves maximum economic growth.

Eggoh and Khan (2013) investigated the non-linear relationship between inflation and economic growth, using the Panel Smooth Threshold Regression (PSTR) model. Their empirical results substantiated both views and validated the fact that inflation-growth non-linearity is sensitive to the level of financial development, capital accumulation, trade openness and government expenditures. They concluded that, the country characteristics brought some marked differences in this non-linear relationship.
Jha and Dang (2011) examined the effect of inflation variability and economic growth using annual historical data on both developing and developed countries. Their results showed that for developing countries, there is significant evidence to suggest that when the rate of inflation exceeds 10 percent inflation variability has a negative effect on economic growth; and for developed countries, there is no significant evidence that inflation variability is detrimental to growth.

Kabundi (2012) studied the Dynamics of Inflation in Uganda and identified main factors underlying inflation in Uganda, both in the long- and short-run, her main finding shows that both external and domestic factors explain dynamics in inflation in Uganda. Over the long-run, monetary aggregate, world food prices, and domestic supply and demand effects in agricultural sector are main determinants of inflation in Uganda. While money growth, world food prices, and energy prices, combined with domestic food prices have short-term impact on inflation. Finally, the study finds evidence of inflation inertia which can be attributed to expectations of agents and/or inflation persistence.

Alani (2012) assessed the effects of growth in capital and money supply on inflation in Uganda from 1970 to 2009 using both the linear regression model and Error Correction Model (ECM) methods. The study confirmed inflation was more of a capital stock than a monetary phenomenon. In the case of capital stock the inflation within the period could have been brought about by expenditures on capital within sectors that were not directly productive, leaving the production of essential commodities to only a few firms in the domestic market; thus leading to shortage of essential commodities, excess demand for them
and consequently inflation. This might be an evidence for reverse causation of the inflation-growth relationship.

Rutayisire (2013) studied the threshold effects in the relationship between inflation and economic growth in Rwanda; the findings revealed that at low levels, inflation does not hurt economic growth, while at higher levels, inflation reduces economic growth. And also found the estimated inflation threshold level to be 14.97%. the Granger causality test was performed to investigate the linear causation between inflation and growth in the regression model; the results of the test estimates revealed a unidirectional causality running from inflation to growth and no feedback effect from growth to inflation was detected, implying that the simultaneity bias does not seriously affect the coefficient of inflation in the regression model.

Mamo (2012) investigated the relationship between inflation and economic growth: the study use panel data of 13 SSA countries from 1969 to 2009. The study result indicates that there is a negative relationship between economic growth and inflation. This study is also examined the causality relationship between economic growth and inflation by using panel Granger causality test. Panel granger causality test shows that inflation can be used in order to predict growth for all countries in the sample, while the opposite it is only true for Congo, Dep. Rep and Zimbabwe.

José, Lopes, and Alexandra (2015) analyzed the relationship between public debt, economic growth and inflation in a group of 52 African economies between 1950 and 2012. The results indicate that the limits of public debt are negatively related to economic growth and exhibit, from a given level of debt, an inverted U behavior regarding the relationship between economic growth and public debt. The results for three specific geographical areas resemble those of the overall analysis, despite some differences. In North African countries, the growth
rates of the gross domestic product (GDP) and inflation also show an inverted U behavior as the ratio of public debt/GDP increases. The highest rate of economic growth is recorded when the ratio of public debt/GDP is below 30% of GDP and corresponds to an average inflation rate of 5.33%. An identical behavior of the GDP growth rates and inflation also appears in Sub-Saharan countries until the third interval (60–90%). However, the highest growth rate of the GDP and GDP per capita is registered when the public debt/GDP ratio is in the second interval (30–60%). For the countries of the Southern Africa Development Community, the highest average rate of economic growth (6.8%) is similar to North African countries, when the ratio public debt/GDP is below 30% of GDP, with an average inflation rate of 11%. A number of robustness analyses were performed and the great majority of them confirm the general analysis.

Bittencourt, Eyden, and Seleteng (2015) in this paper investigated the role of inflation rates in determining economic growth in fifteen sub-Saharan African countries, which are all members of the Southern African Development Community (SADC), between 1980 and 2009. The results, based on panel time-series data and analysis, suggest that inflation has had a detrimental effect to growth in the region. All in all, the study highlight not only the fact that inflation has offset the prospective Mundell-Tobin effect and consequently reduced, the much needed, economic activity in the region, but also the importance of an institutional framework conducive to a stable macroeconomic environment as a precondition for development and prosperity in the community.

2.5 Lessons from the Literature

Various factors explain the relationship between inflation and economic growth and from the foregoing discussion, generally, inflation can be explained basing on three major theories; neoclassical model, Keynesian theory, Structuralists theory, monetary theory and the cost
push theory theories. The problem is that these theoretical models are analyzed in the context of developed economies. Application of most of these models in developing countries is limited by mostly data unavailability on variables and structural rigidities of growing economies given the underlying assumptions like perfect competition, perfect information flow, among other constraints.

From the literature reviewed on the effects of inflation on economic growth it is clear that it has attracted a considerable disparity in both the theoretical and empirical literature. Both literatures revealed contradicting views about the effect of inflation on the economic growth. Starting from the theoretical literature the impact of or relationship between inflation and economic growth is not clear. The Structuralists and Keynesians see inflation as good for economic growth i.e. Keynes (1958) found that high inflation causes low rates of unemployment, therefore affects growth positively while the monetarists and the cost push theory view it as bad for growth. The above controversy is also further revealed by the empirical literature as all the studies done show that no clear consensus has been reached on either the impact of inflation on economic growth or relationship between inflation and growth.

From our study most of the empirical literature has shown that increase in inflation leads to a decrease in economic growth i.e. Yabus and Kessy (2015), Kasidi and Mwakanemela (2013) and Jha and Dang (2011) while Wambui (2013) and Rutayisire (2013) argued that inflation has a positive effect on growth. Since most of the studies have debated about the impact of inflation on economic growth and the relationship between inflation and economic growth hitherto no consent has been reached therefore further research is needed. This study aims at filling this gap by adding using more recent data and addressing inflation with respect to economic growth.
CHAPTER THREE

METHODOLOGY

3.1 Introduction

This section presents the theoretical framework of the study this includes the framework of the impact of inflation on economic growth as well as relationship between inflation and economic growth. It shows how the stationary co-integration and coefficient of elasticity tests would be conducted and the models that were estimated.

3.2 Theoretical frame work

This study adopted the Keynesian theory where the presence of under-employment and increase in money supply leads to an increase in aggregate demand which leads to a proportionate increase in output and employment in the economy. But as aggregate demand, output and employment continue to rise, diminishing returns start and semi-inflation crops in thus prices start rising and this process continues until full employment level is reached.

Adopting from the works of Kigume (2005) therefore this means the study model is from a typical model Keynesian formulation of aggregate supply which is;

\[ \ln P_t = \ln P_{t-1} + \pi^*_t + \lambda (\ln Y_t - \ln Y^*_t) + \varepsilon^s_t \quad \text{Where} \quad \lambda > 0 \]

\[ \pi_t + \pi^*_t + \lambda (\ln Y_t - \ln Y^*_t) + \varepsilon^s_t \]

Where \( \pi_t \equiv \ln p_t - \ln P_{t-1} \) is inflation

Then;

\( \lambda (\ln Y_t - \ln Y^*_t) \) - Implies that at any time, there is an upward sloping relationship between inflation and output; the relationship is log-linear meaning that (\( \lambda > 0 \))

\( \varepsilon^s \) - captures supply shocks

\( \pi^* \) - is what inflation would be if output is equal to its natural rate and there are no supply shocks. It is known as the core or underlying inflation.
\( \pi^* \) t-\( \)t\( \)\(-1\) \- Equals the previous period's actual inflation, that \( \pi^* \) \( t = \pi_{t-1} \)

The above shows that there is a tradeoff between output and the change in inflation, but no permanent tradeoff between output and inflation. According to study for inflation to be held steady at any level, output must equal the natural rate however for inflation to fall there must be a period when output is below the natural rate (Kigume, 2005).

Ex-post facto research design which refers to research design that utilizes existing data on past events was adopted for this study. The justification for using this design is that the study has utilized the already existing quantitative data on past events for which the relevant variables cannot be manipulated.

3.2.1 Data analysis

The study used both descriptive and econometric analysis. Inflation rate measured using the (CPI) and real Gross Domestic Product (GDP) at current price was used as a proxy for growth. Then a stationarity test was performed using the ADF and Phillip-Perron tests to check for stationarity in the variables, the Johansen Co-integration test was used to test co-integration between variables, then the econometric approach was used to investigate the impact of inflation on economic growth.

The study has therefore specified a model to examine the impact of inflation on economic growth as well as the relationships between inflation and economic growth. The models specified were then estimated using Correlation coefficient and co-integration technique to establish the relationship between inflation and economic growth (GDP). The coefficient of elasticity was applied to measure the degree of responsiveness of change in economic growth (GDP) to changes in general price levels.
3.2.2 The analytical model

Which means the impact of inflation on economic growth can be analyzed using the following growth regression model:

\[ \partial \ln Y_t = \alpha + \beta X_t + \varepsilon_t \]  \hfill (3.3)

Where;

\( Y \) is the real output,

\( X_t \) is the vector of explanatory variables,

\( \beta \) is the matrix of parameters ,

\( \alpha \) is a constant and \( \varepsilon_t \) is the error term.

When the model is expanded to capture the relation between economic growth and inflation they achieved the following linear regression model:

\[ \partial \ln Y_t = \alpha + \beta_1 X_t + \beta_2 \pi_t + \varepsilon_t \]  \hfill (3.4)

where \( \partial \) is the first difference operator and \( \partial \ln Y_t \) is the growth rate of real GDP approximated by the first difference of \( Y_t \). \( \pi_t \) represents inflation defined as the annual growth rate in prices measured by the first difference of the INF, and \( X_t \) is the vector of other explanatory variables, \( \beta \) is the matrix of slope coefficients and \( \varepsilon_t \) is the random error term.

3.2.3 Empirical Model

The study has specified the following model in order to investigate the impact of inflation on economic growth and the relationship between inflation and economic growth of Kenya. The study specified the following model which is a reduced form regression equation.

\[ \text{GDP}_t = \alpha + \beta_1 \text{INF}_t + \beta_2 \text{EXR}_t + \beta_3 \text{INTR}_t + \beta_4 \text{M2}_t + \varepsilon_t \]  \hfill (3.5)

Where GDP stands for Gross domestic product,
INFL= Inflation, 
EXR = Real exchange rate, 
INTR= Real interest rate, 
M2 = Broad money 

$\beta$ is a parameter and $\alpha$ is a constant

3.3 Variables Definition and description

Real GDP per capita growth rate (GDP) is the annual growth rate of total market value of all final goods and services per capita, produced with domestic factors of production relative to GDP. And it’s measured in annual (%) percentage the priori expectation for the lagged variable is Positive.

Inflation (INF) as measured by the consumer price index reflects the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly.

Monetary supply/ Broad money (M2)

Sum of currency in circulation and deposits (cheque deposit, time and saving deposits) it’s measured as (%) percentage of GDP. Increase in money (M2) in the economy has a direct effect in the demand of commodities in the economy which further leads to an increase in prices resulting to inflation. This was expected to have a positive sign.

Exchange Rates

Exchange rate (EXR) in finance, the exchange rate (also known as the foreign exchange rate, forex trade) between two currencies specifies how much one currency is worth in terms of the other. The exchange rate has a direct impact on the price of exports and imports in the
country and increased money supply leads to the depreciation of the nominal exchange rate. This was expected to have a negative sign.

In this study it is measured using Official exchange rate refers to the exchange rate determined by national authorities or to the rate determined in the legally sanctioned exchange market. It is calculated as an annual average based on monthly averages (local currency units relative to the U.S. dollar).

**Real interest rate (INT)**

This also is the rate of interest an investor expects to receive after allowing for inflation. It is approximately the nominal interest rate minus the inflation rate.

### 3.4 Data type and source

The data used in this study is time series data and was sourced from the World Bank data base (The World Development Indicators, 2017)

### 3.5 How to measure the Coefficient of Elasticity as a measure of degree of responsiveness

This study used the logarithmic technique to measure the responsiveness of GDP to changes in inflation. Therefore to achieve the objective of this study was to compute the elasticity by margins as it related to the coefficients of the log linear model and our model here was a log linear model. In this study therefore the term elasticity here was used to describe the coefficient of the model

\[
\ln(Y) = \beta_0 + \beta_2 \ln(X) \tag{3.6}
\]

The above is called a constant elasticity model. When we convert it to become

\[
y = C_0 + C_1 x \tag{3.7}
\]
And compute \( d(\ln(f))/d(\ln(x)) \), where \( f \) is the linear predictor, this is a function of \( X \). We can evaluate this function at any value of \( x \) we please. Which make this a varying elasticity model and in an underlined elasticity with non-linear regression equation using

\[
\ln(Y) = \alpha + \beta \ln(X) + \varepsilon,
\]

\( \beta \) is interpreted as elasticity thus any regression that containing both logged dependent and explanatory variables \( Y \) tends to change by \( \beta \) percent for one percent change in \( X \). implying that regression results using logged variables are always interpreted as elasticity. Therefore, for the purpose of getting elasticity in the linear reduced form regression equation, this study used the following model;

\[ Y = \beta_0 + \beta_1 X \text{ where elasticity becomes } \frac{\beta_1 X}{Y}. \]  

(3.8)

Where \( Y \) = GDP Growth rate and \( X \) = Inflation rate (INFL).

When equation (5) is transformed into logarithm it becomes:

\[
\log GDP_t = \alpha + \beta_1 \log INF_t + \beta_2 \log EXR_t + \beta_3 \log INTR_t + \beta_4 \log M2_t + \varepsilon_t \]  

(3.9)

To measure the responsiveness of GDP to changes in inflation we left out all other variables and use only inflation and GDP therefore;

\[
\log GDP_t = \alpha + \beta_1 \log INF_t \]  

(3.10)

Where \( \beta_1 \) is elasticity, therefore equation (10) is our measure of the degree of responsiveness of change inflation to GDP growth rate in Kenya.
3.6 Econometric analysis

3.6.1 Stationarity of data

Before conducting regression and correlation tests, the two variables were to be individually tested for stationary. To test for stationarity, the Augmented Dickey Fuller (ADF) and the Phillips Perron tests were proposed. The ADF test had an advantage over the Phillip (PP) test since the ADF test accounts for higher auto correlations in the residuals. The ADF equations used were as follows:

The ADF equations used were as follows:

\[
\Delta y_t = \alpha_0 + (\alpha_1 - 1) y_{t-1} + \sum_{i=1}^{p} \beta_i \Delta y_{t-i} + \mu_t \] …………………………………………………………… (3.11)

\[
\Delta y_t = \alpha_0 + (\alpha_1 - 1) y_{t-1} + \alpha_{t-2} + \sum_{i=1}^{p} \beta_i \Delta y_{t-i} + \mu_t \] …………………………………………………………… (3.12)

The simple Dickey Fuller tests assume that the errors are independent and had a constant variance. With the Augmented Dickey-Fuller tests, the unit root tests were valid even with the presence of serial correlation of unknown form, for example say AR (p) process. If the null hypothesis of a unit root (non-stationary) is rejected, a time series will be considered as integrated of order zero, i.e. I (0), in levels. If not, the time series will not be stationary in levels but was stationary at first difference.

3.6.2 Correlation Analysis

Correlation refers to the quantitative measure of the degree or strength of relationship that may exist between two variables. If X and Y are two variables, the correlation coefficient is given by the ratio of the covariance between X and Y to the product of the standard deviation of X and that of Y. And can be expressed in the following way:

\[
r_{XY} = \frac{\text{Cov}(X,Y)}{\sigma_X \sigma_Y} \]
The covariance in the numerator gives a measure of the simultaneous change in the two variables and is divided by product of the standard deviation of X and Y to make the measure free of any unit in order to facilitate a comparison between more than one set of bivariate data which may be expressed in different units. Thus, this measure of correlation coefficient is independent of a shift in the origin and a change of scale. The correlation coefficient lies between +1 and -1. The correlation coefficient is positive when the two variables tend to move in the same direction but when the two variables tend to move in the opposite directions then the correlation coefficient assumes a negative value. This study conducted correlation analysis on the data collected in order to determine the nature of relationship and as well ensure that there was no multi-collinearity amongst the variables. It may be observed that correlation does not imply causality.

3.6.3 Co-integration test

Two variables are said to be co-integrated if they have a long-term, or long run equilibrium, relationship between them. If two variables, dependent and an independent, are individually non-stationary but their residual (combination) is stationary, those variables are co-integrated on the long run. In this case the researchers used the Johansen co-integration test to test co-integration since it is the only test which can estimate more than one co-integration relationship if the data set contains two or more time series as well as gives the maximum rank of co-integration. Two variables X and Y are said to be co-integrated of order one, I (1) if both are integrated of order one and there exists a linear combination of the two variables that is stationary, I (0). The linear combination is given by either:

\[ Y_t = \alpha_0 + \beta_0 X_t + \mu_{0t} \] .................................................. (3.13)
\[ X_t = \alpha_1 + \beta_1 Y_t + \mu_{1t} \] .................................................. (3.14)
CHAPTER FOUR

EMPIRICAL FINDINGS

4.1 Introduction

This study aimed at investigating the relationship between inflation and economic growth (macro-economic variables) in Kenya as well as examining the impact of inflation on economic growth. This chapter comprises of the data presentation, estimation and results of the empirical investigation carried out.

4.2 Descriptive Results

The descriptive contains the measures of central tendency which include mean, minimum, and maximum as well as measures of variation and other statistical characteristics of the variables is presented in the table below.

Table 4.1: Descriptive Statistics from 1977 and 1985

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross Domestic product</td>
<td>4.146154</td>
<td>2.464415</td>
<td>-.799494</td>
<td>9.453798</td>
</tr>
<tr>
<td>Inflation</td>
<td>12.74398</td>
<td>8.422543</td>
<td>1.554328</td>
<td>45.97888</td>
</tr>
<tr>
<td>Money supply</td>
<td>31.90999</td>
<td>10.16472</td>
<td>.7826636</td>
<td>42.6063</td>
</tr>
<tr>
<td>Exchange Rate</td>
<td>51.793</td>
<td>29.95041</td>
<td>12.26496</td>
<td>98.76969</td>
</tr>
<tr>
<td>Real Interest Rate</td>
<td>7.30381</td>
<td>6.368661</td>
<td>-8.009867</td>
<td>21.09633</td>
</tr>
</tbody>
</table>

Source: Authors computation

The results from table 4.1 shows that Kenya’s GDP has been growing over time with an average of 4.1%, a minimum growth of -.79% and the maximum growth of 9.5% and this has an implication on economic growth. INFCPI had an average of 13% and has been increasing from 1.6% to 46%. This can be explained by the persistent rise in consumer prices; M2 had an average of 32% and has been increasing from 26.7% to 42.61%. The EXR very high exchange rate with an average 52, a minimum of 12 and maximum of at 98.77% this can be
accountable for the current very high prices of foreign currencies. And finally Kenya’s RIR has also been on arise with an average of 7.3%, a minimum of -0.80% and a maximum of 21% the rise in M2 could be attributed the current high lending rates in the economy.

4.3 Correlation analysis

Correlation matrix shows what kind relationship exists between two variable i.e. the independent and dependent variables. It indicates the direction of relationship between two variables and how one variable is related to another. The results showing the correlation among the independent and dependent variables is presented in the table below.

**Table 4.2: Correlation matrix before differencing**

<table>
<thead>
<tr>
<th>Variables</th>
<th>GDP</th>
<th>INF</th>
<th>M2</th>
<th>EXR</th>
<th>RIR</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gross Domestic</strong></td>
<td>1.0000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>product</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inflation</td>
<td>-0.4878</td>
<td>1.0000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Money supply</td>
<td>-0.1326</td>
<td>0.0460</td>
<td>1.0000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exchange Rate</td>
<td>-0.3431</td>
<td>-0.2384</td>
<td>0.8375</td>
<td>1.0000</td>
<td></td>
</tr>
<tr>
<td>Real Interest Rate</td>
<td>-0.1821</td>
<td>-0.3378</td>
<td>0.1889</td>
<td>0.1207</td>
<td>1.0000</td>
</tr>
</tbody>
</table>

*Source: Authors’ computation*

**Table 4.3: Correlation matrix after differencing**

<table>
<thead>
<tr>
<th>Variables</th>
<th>GDP</th>
<th>DINF</th>
<th>DM2</th>
<th>DEXR</th>
<th>DRIR</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gross Domestic</strong></td>
<td>1.0000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>product</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inflation</td>
<td>-0.3655</td>
<td>1.0000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Money supply</td>
<td>-0.1671</td>
<td>-0.1737</td>
<td>1.0000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exchange Rate</td>
<td>-0.3472</td>
<td>0.4510</td>
<td>0.1518</td>
<td>1.0000</td>
<td></td>
</tr>
<tr>
<td>Real Interest Rate</td>
<td>-0.2200</td>
<td>-0.3710</td>
<td>0.3146</td>
<td>-0.0773</td>
<td>1.0000</td>
</tr>
</tbody>
</table>

*Source: Authors computation*

Tables 4.2 and 4.3 present correlation matrix results of multicollinearity test which shows the relationships between explanatory variables. In this case, we are testing for the indirect relationship between inflation, money supply, exchange rate and interest rate on Gross domestic products. According to studies multicollinearity will be severe if the correlation coefficient is greater than 0.8. From the results in table 4.2 inflation(INF) money supply
(M2), exchange rate (EXR) and interest rate (RIR) are all inversely correlated to GDP and some of the explanatory variables are highly correlated, that is money supply (M2) is highly correlated with exchange rate. Therefore there would be a severe problem of Multicollinearity if these variables were together included in a regression. To avoid the problem we conduct the first differences of the collinear variables which is the recommended as one of the remedy. And the results is presented in table 4.3 where all the variable i.e. inflation (INF), interest rate (RIR), money supply (M2) and exchange rate (EXR) are all inversely correlated to GDP and there is no coefficient that is greater than 0.8 and therefore no multicollinearity.

### 4.4 Graphical illustration and analysis of GDP and inflation

The figure 4.1 illustrates the trend of growth and the relationship between gross domestic product (GDP) and inflation in Kenya from the year 1977 to 2016.

**Figure 4.1: Growth trend of GDP and Inflation**

![Graph showing trend of GDP and inflation (1977-2016)](image)

From the figure above, some relationship between gross domestic product (GDP) and inflation may be derived. It can be observed that in the beginning years of our observation both GDP and inflation were growing concurrently; however in the preceding years i.e. from
1985, in periods when inflation fall gross domestic product (GDP) tend to increase for instance in the years 1986 1995 and 2010; but then in years when inflation was high current gross domestic product (GDP) declined as can clearly be seen in the year 1985 when inflation was high GDP was low and only declined in 1986 one of the few years in which Kenya registered the 2nd highest GDP for the rest of years inflation increased while GDP declined and in the years 1992, 1993 and 1994 show the worse decline in GDP to -0.7995, and 0.3532 while inflation was at its peak at 27.3324, 45.9789 and 28.814 respectively.

The decline in inflation in 1995 led to a very Sharpe increase in GDP up to 4.40622 for the first time even higher than inflation only to decline in 1996 an the trend continued till 2008 where inflation hit 26.2398 the 4th and the highest inflation rate registered in the last one decade while GDP decline to 0.23228 the lowest rate ever registered within the last one decade as well only to increase in 2009 when there was a drastic decline in inflation and by 2010 a very sharp decline in inflation lead to arise in GDO to 8.40228 the highest GDP the country has ever registered within the last three (3) decades but from the year 2011 to date inflation has been on arise while GDP dwindling and the trend has continued; this means that inflation has a negative effect on current account balance.

However, we cannot derived a final conclusion from such trend and hence further investigation of the effects and relationships of the inflation together with the rest of the macroeconomic variables on Gross domestic product can only be established by econometric analysis.
4.5 Econometric Analysis

4.5.1 Stationary test

This test is used to check for the order of integration or the presence of unit root which is a very common characteristic of a time series variables and this study we have employed the Augmented Dickey Fuller test. Therefore we test the null hypothesis of non-stationarity of all our variables understudy against the alternative hypothesis of stationarity.

Table 4.4: Stationarity Tests of variables using the ADF

<table>
<thead>
<tr>
<th>Variables</th>
<th>Critical value (5%)</th>
<th>T –statistic</th>
<th>Order of integration</th>
<th>Level of significance</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross Domestic product</td>
<td>-3.655</td>
<td>-3.795</td>
<td>I(0)</td>
<td>5%</td>
<td>0.0030</td>
</tr>
<tr>
<td>Inflation</td>
<td>-3.355</td>
<td>-3.416</td>
<td>I(0)</td>
<td>5%</td>
<td>0.0104</td>
</tr>
<tr>
<td>Money supply</td>
<td>-3.655</td>
<td>-3.645</td>
<td>I(0)</td>
<td>5%</td>
<td>0.0050</td>
</tr>
<tr>
<td>Exchange Rate</td>
<td>-3.655</td>
<td>-5.889</td>
<td>I(1)</td>
<td>5%</td>
<td>0.0000</td>
</tr>
<tr>
<td>Real Interest Rate</td>
<td>-3.655</td>
<td>-4.123</td>
<td>I(0)</td>
<td>5%</td>
<td>0.0009</td>
</tr>
</tbody>
</table>

*Source:* Authors computation

From table 4.4 the Augmented Dickey-Fuller (ADF) unit root tests results show that the variable GDP, INF, M2 and RIR, are stationary at levels while EXR became stationary after differencing. Thus all the time series are stationary in their levels and therefore we reject the hypothesis of unit root.
4.5.2 Graphical results for Augmented Dickey-Fuller (ADF) test for unit root

Graphs depicting stationarity and non-stationarity of variables at levels and after differencing

Figure 4.2: Graphs showing GDP stationarity of variable at levels

![Graph showing GDP stationarity at levels](image)

Figure 4.3: Graphs showing INF stationarity of variables at levels

![Graph showing INF stationarity at levels](image)

Figure 4.4: Graphs depicting M2 stationarity of variables at levels

![Graph depicting M2 stationarity at levels](image)
4.6 Co-integration Analysis

Co-integration rank is estimated using Johansen method and using that approach it derives two likelihood estimators for the CI rank namely a trace test and a maximum Eigen value test. The CI rank \( r \) can be formally tested with the trace and the maximum Eigen value statistics. The trace statistic either rejects the null hypothesis of no co-integration among the
variables or accepts the null hypothesis that there is one co-integration relation between the variables. This implies we accept the null hypothesis of co-integration or reject it, if there’s no co-integration.

**Table 4.5: Johansen tests results**

<table>
<thead>
<tr>
<th>maximum rank</th>
<th>parameters</th>
<th>eigenvalue</th>
<th>trace statistic</th>
<th>5% critical Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$r = 0$</td>
<td>30</td>
<td></td>
<td>82.0438</td>
<td>68.52</td>
</tr>
<tr>
<td>$r = 1$</td>
<td>39</td>
<td>0.66178</td>
<td>40.8500*</td>
<td>47.21</td>
</tr>
<tr>
<td>$r = 2$</td>
<td>46</td>
<td>0.45532</td>
<td>17.7627</td>
<td>29.68</td>
</tr>
<tr>
<td>$r = 3$</td>
<td>51</td>
<td>0.24486</td>
<td>7.0903</td>
<td>15.41</td>
</tr>
<tr>
<td>$r = 4$</td>
<td>54</td>
<td>0.14792</td>
<td>1.0075</td>
<td>3.76</td>
</tr>
<tr>
<td>$r = 5$</td>
<td>55</td>
<td>0.02617</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Source: Authors computation*

Table 4.5 shows that there is two co-integrating equation at 5 % level of significance therefore H0: $r = 1$ is not rejected at the 5% level. This means there is a long run relationship among the variables used in the study. This necessitated the establishment of the long run relationship between the dependent variable and independent variables using the vector error correction model for all the five variables that are co-integrated.

**4.7 Vector Error-Correction Model**

The Johansen test for co-integration results above shows that there is co-integration and is shown by the rank; and from the above results the co-integration rank ($r = 1$) shows that there is a long run relationship between GDP and Inflation. This therefore makes it necessary to specify an error-correction model. This means that the equation is differenced and an error-correction term measuring the previous period’s deviation from long-run equilibrium is included. When the speed is more than 50 percent then the speed is very high. When it is
below 50 percent then the speed is low. Always the coefficient of the residual term incorporated in the error correction model must be negative and statistically significant.

**Table 4.6: Vector error-correction model results**

<table>
<thead>
<tr>
<th>Variables(D_GDP)</th>
<th>Coefficient</th>
<th>Stand Error.</th>
<th>T statistic</th>
<th>Prob</th>
</tr>
</thead>
<tbody>
<tr>
<td>Error Correction Term_1</td>
<td>-.5862403</td>
<td>.2066604</td>
<td>-2.84</td>
<td>0.005</td>
</tr>
<tr>
<td>D_Inflation</td>
<td>-.334959</td>
<td>.1257699</td>
<td>-2.66</td>
<td>0.008</td>
</tr>
<tr>
<td>D_Money supply</td>
<td>-.8031475</td>
<td>.2900217</td>
<td>-2.77</td>
<td>0.006</td>
</tr>
<tr>
<td>D_Exchange rate</td>
<td>-.2977359</td>
<td>.1698524</td>
<td>-1.75</td>
<td>0.080</td>
</tr>
<tr>
<td>D_Real Interest Rate</td>
<td>-1.815025</td>
<td>.4113158</td>
<td>-4.41</td>
<td>0.000</td>
</tr>
<tr>
<td>_constant</td>
<td>.105386</td>
<td>2.18e-08</td>
<td>4.8e+06</td>
<td>0.000</td>
</tr>
</tbody>
</table>

Hannan-Quinn Information Criterion (HQIC) 29.8641
Log Likelihood -502.4114

**Source:** Authors computation

Table 4.6 show the adjustment parameters and that there is a negative relationship between GDP and INF i.e. coefficient of -.5862403 implies that in the long run all the errors are corrected by 58% at a 5% level of significance. This shows that there is a long run causality running from inflation (INF), Money supply (M2), exchange rate (EXR), and Interest rate (RIR) to gross domestic product. The coefficient is negative and this shows adjustment to equilibrium; hence using our standard the speed of adjustment to restore long run equilibrium is 58 percent per year, and it will take roughly one year to completely recover from a single shock and restore long run equilibrium.

The above results show the possibility of convergence to an equilibrium level in the long run. Therefore, the existence of a significant feedback relationship between inflation and economic growth that runs in both directions is evidenced.
4.8 Johansen normalization restriction

The study has used the Johansen normalization from the vector error correction model to interpret the impact of inflation on economic growth.

The table below shows the normalized co-integration co-efficient, standard error and p-value

<table>
<thead>
<tr>
<th>Variables</th>
<th>Coefficient</th>
<th>Stand Error.</th>
<th>T statistic</th>
<th>Prob</th>
</tr>
</thead>
<tbody>
<tr>
<td>D_GDP</td>
<td>1.0000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D_Inflation</td>
<td>-1.03e+07</td>
<td>.8906352</td>
<td>-1.2e+07</td>
<td>0.000</td>
</tr>
<tr>
<td>D_Money supply</td>
<td>-3150515</td>
<td>.3809883</td>
<td>-8.3e</td>
<td>0.006</td>
</tr>
<tr>
<td>D_Exchange rate</td>
<td>-.1629176</td>
<td>.0872447</td>
<td>-1.87</td>
<td>0.062</td>
</tr>
<tr>
<td>D_Real Interest Rate</td>
<td>-1.03e +07</td>
<td>.9081021</td>
<td>.9081021</td>
<td>0.000</td>
</tr>
<tr>
<td>Ec_L1</td>
<td>-7.56e +07</td>
<td>5.358685</td>
<td>-1.4e+07</td>
<td>0.000</td>
</tr>
<tr>
<td>_constant</td>
<td>6.25e+08</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Source: Authors computation*

From the results above a unit change in inflation leads to a decreases in GDP by -1.03 which is 10% and it is statistically significant at 5 level% of significance. The above implies that there is negative long run relationship between inflation and growth. This means that inflation has a negative effect on economic growth. This finding conforms to that of Barro (1995), Bruno and Easterly (1998) Gokal and Hanif (2004), Kasidi and Mwakanemela (2013) and (Yabus and Kessy (2015) who found that inflation has a negative effect on economic growth. Therefore the negative impact in the empirical results above can be explained by the fact that the level of inflation in Kenya is high thus it killing the business optimism and which in turn discouraging investment that should have boosted economic growth.
The results show that on the impact of money supply a unit increases in (broad money) M2 by 1 reduces GDP by -3150515 at the 5% level of significance. This means money supply has a negative effect on economic growth and this is similar to that of Kabundi (2012) who found that money growth is detrimental to economic growth.

The results on the estimation of the impact of real exchange rate an increase in EXR by 1 unit is leads to a reduction of GDP by -.1629176 at the 5% level of significance. This means that exchange rate has a negative effect on economic growth. The empirical finding of this study is similar to that of Alagidede and Ibrahim (2016). The above can be attributed to the fact that very high exchange rates makes producers to buy production materials at very high price therefore they end up selling at very high price especially for the case of developing countries where most raw materials for production are imported and Kenya in one of them. Therefore resulting into a negative impact on growth as some researcher argued that exchange rate volatility can negatively influence some key determinants of economic (Katusiime, Shamsuddin and Frank, 2016).

In the estimation of the impact of interest rate a change in RIR by 1 unit is going to reduced GDP by -1.03 at the 5% level of significance. This means that real interest rate has a negative effect on economic growth, this is because it increases the cost of fund needed for investment hence it discourages investment. The above empirical finding is similar to that of Gokal and Hanif (2004) who found that interest rate has an inverse relationship with economic growth. This can be explained by the fact that when banks increase lending rates investors and producer transfer this cost in form of high price on good that they produce thus resulting into inflation.
The regression result also shows that inflation has a negative significant impact on economic growth. The above finding implies that the inflation rate in Kenya is very high and hence not good for economic growth.

### 4.9 Diagnostic test

To confirm the reliability of long-run regression equation post diagnostic test where run on both Vector Error Correction Model (VECM) and Ordinary Least square Method.

#### 4.9.1 Post estimation test

These are some additional tests that were applied to confirm the reliability of long-run regression equation.

#### 4.9.2 LM Test for serial correlation

**Table 4.8: Lagrange-multiplier test**

<table>
<thead>
<tr>
<th>Lag</th>
<th>Chi2</th>
<th>Df</th>
<th>Prob&gt; chi2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>26.2839</td>
<td>25</td>
<td>0.39257</td>
</tr>
<tr>
<td>2</td>
<td>36.1506</td>
<td>25</td>
<td>0.06935</td>
</tr>
</tbody>
</table>

H0: no autocorrelation at lag order

Decision: p>chi2, we reject the null

From the test result above we accept the null that there is no serial correlation in the model.
4.9.3 The Jarque-Bera test for normality

Table 4.9: Jarque-Bera test

<table>
<thead>
<tr>
<th>Equation</th>
<th>Chi2</th>
<th>Df</th>
<th>Prob&gt; chi2</th>
</tr>
</thead>
<tbody>
<tr>
<td>D_GDP</td>
<td>2.087</td>
<td>2</td>
<td>0.35216</td>
</tr>
<tr>
<td>D_INF</td>
<td>3.615</td>
<td>2</td>
<td>0.16403</td>
</tr>
<tr>
<td>D_M2</td>
<td>0.560</td>
<td>2</td>
<td>0.75573</td>
</tr>
<tr>
<td>D_EXR</td>
<td>2.448</td>
<td>2</td>
<td>0.29402</td>
</tr>
<tr>
<td>D_RIR</td>
<td>1.893</td>
<td>2</td>
<td>0.38818</td>
</tr>
<tr>
<td>ALL</td>
<td>10.604</td>
<td>10</td>
<td>0.83922</td>
</tr>
</tbody>
</table>

Null hypothesis: The model is normally distributed and the decision rule is to accept the null hypothesis if probability is greater than 50%. And from the above results the model is normally distributed since p = 0.83(83%).

Therefore we accept the null hypothesis that errors are normally distributed at 5 percent significance level. Therefore, the VECM results are presumed to be consistent in policy formulation and decision making.

4.9.4 Breusch-Pagan / Cook-Weisberg test for Heteroskedasticity, Multicollinearity test and Test for omitted variable

Breusch-Pagan / Cook-Weisberg test for Heteroskedasticity results had a P value of 0.5879 therefore we accept the null hypothesis of constant variance. This indicated that the variance of the error term is constant across observations. The Ramsey RESET had a Prob > F = 0.1779 this means that model has no omitted variables. And finally the multicollinearity test had a VIF of 1.63 for all the variables; this is less than 5 implying that there is no problem of multicollinearity.
4.10 Discussions

The coefficient of economic growth is negative showing that there is an inverse relationship between inflation and economic growth in the short run. And the in the long run, this relationship has remained negative. This study therefore agrees with the monetarists view that high inflation rate is detrimental to economic growth rate. And this is applicable in both the short run and the long run, which means that it disagrees with the view that inflation is good for growth as proposed by the structuralists.

Empirically, these results are similar to Bruno and Easterly (1998) who established that there was a negative short run relationship between inflation and economic growth. The empirical results presented show both the short run negative relationship and the long run negative relationship between inflation and economic growth. Eggoh and Khan (2013) and Jha and Dang (2011) also found a short to medium run negative relationship between these two variables. Other studies that also established a negative relationship between inflation and economic growth in the short run are Kasidi and Mwakanemela (2013), Yabus and Kessy (2015) and (Gokal and Hanif, 2004). The results of this study, however, differ from those of other studies like Fisher (1993) Rutayisire (2013) and Tadele (2014) who found a positive short run relationship between inflation and growth.

4.11 Conclusion

In this chapter carried out data analysis and interpretation we started the descriptive analysis which contained a summary of data statistics followed by the empirical analysis where unit root, co-integration and vector error correction tests and ordinary least square method were carried out. The Augmented Dickey Fuller (ADF) test was used to check for stationarity; it revealed that three of the variables GDP, INF, and RIR are stationary at levels but M2 and EXR became stationary after first difference. The Johansen Co-integration test showed long run relationship among the variables. The Vector Error correction Coefficient showed that
about 16 Percent of the errors will be corrected in the long run leading to a convergence. And finally the ordinary least square results revealed inflation has a negative impact on economic growth.
CHAPTER FIVE

CONCLUDING REMARKS

5.1 Introduction

This chapter presents the summary, conclusions and policy implications of the study. The chapter is divided into three sections. Section 5.2 presents the summary of the study, section 5.3 presents the main conclusions, section 5.4 covers the policy implications arising from the study findings, and section 5.5 recommendation section 5.6 presents areas for further research.

5.2 Summary

The study examined inflation and economic growth in Kenya. To achieve its objectives the study applied the vector error correction model (VECM) using time series data for the period 1985-2016. An evaluation of the trend of GDP growth rate and inflation showed an inverse volatile relationship between the variables shown by the rate at which they are fluctuating. The empirical results reveal that inflation (INF), money supply (M2) exchange rate (EXR), and interest rate (RIR) all have a negative impact on economic growth (GDP). Therefore inflation does not stimulate economic growth in Kenya.

In general it can be concluded that growth in Kenya is more affected by inflation other than other macroeconomic variables. The above finding is in line with the Keynesian and Neo-Keynesian theoretical framework.
5.3 Implications for policy

The Vector Error Correction Model shows the existence of a negative significant relationship between inflation and economic growth in Kenya both in the short and long run. Implying that a very high level of inflation reduces economic growth; notwithstanding the fact that high level of inflation is harmful for the country. This finding also shows a relatively weak fiscal and monetary policy in Kenya.

The negative significant effect of inflation on growth imply that policy should focus on other macroeconomic variables like interest rate and exchange rate that both have negative impact on economic growth attention should also be paid on other structural bottlenecks affecting growth as well.

Economic growth and inflation rates are so volatile in Kenya, indicating the monetary policy adopted by Kenya is not as effective as expected in the stabilization of the economy as a whole.

Money supply (M2) has a negative relationship with the economic growth; this implies that the fiscal and monetary being employed is not effective in reducing the supply of money thereby reducing the rate of inflation.

Exchange rate is negatively related to economic growth, In line with this finding the government should put in place policies that will regulate exchange rate in Kenya this is because its volatility is detrimental to economic growth for example having a fixed rate that is regulated by the central bank.

Interest rate has a negative relationship with the economic growth an implication that it is significant in causing the variation in economic growth.
5.4 Recommendation

The government and policy makers should put in place policies that work towards stabilization of the economy by adopting the appropriate policy measures like tightening of the fiscal and the monetary policy.

The government should focus on and put in place policies that will help them achieve stabilized prices since it is considered as a proxy for macroeconomic stability and the ongoing high level of inflation is not a good sign.

And the VECM results show that the effect of inflation on economic growth is much stronger than the effect of economic growth on inflation in Kenya. Therefore in targeting long run sustainable development emphasis should be given to accelerate economic growth and find the threshold growth-inflation level, so that growth rate takes care of the stability in inflation.

This needs a rigorous effort to develop the financial market by the introduction of new financial technologies, building the confidence of the people in the system and easing access to banking services in the country. As a result, the transmission mechanism will get faster and the time it takes to achieve equilibrium level will be shorter.

Therefore, focus should be given on policies that will achieve price stability in the country and this demands further research in identifying factors affecting the level of inflation in the country.

The monetary authority should do all within its ability to ensure that they come up with sound fiscal and monetary policies to help curb any spiraling inflation and uphold the highest degree of confidence within the investing community.
Since Money supply (M2) has a negative relationship with the economic growth; the Kenyan government should put in place fiscal and monetary that are effective in reducing the supply of money thereby reducing the rate of inflation.

Exchange rate is also negatively related to economic growth. In line with this finding the government should put in place policies that will regulate exchange rate in Kenya this is because its volatility is detrimental to economic growth for example having a fixed rate that is regulated by the central bank.

This study further recommends that the government ensures prudential management of the exchange rate. Because for a developing country such as Kenya with a market determined exchange rate; it is necessary to ensure that the macroeconomic fundamentals that affect the exchange rate are well managed to mitigate the volatility.

The interest rate and economic growth are the main instruments policy makers should aim at in controlling the inflation rate. Therefore policy makers should adopt policies that mitigate increase in interest rates. Interest rate is the major tool used by the central bank to achieve inflation target. Changes in this interest rate affect various kinds of economic activity and thereby, over time, inflation. Interest policy is effective in reducing the supply of money thereby reducing the rate of inflation.

The monetary authority should do all within its ability to ensure that they come up with sound fiscal and monetary policies to help curb any spiraling inflation and uphold the highest degree of confidence within the investing community.

5.5 Suggestions for further research

Further research should be done on this particular topic using other methods of analysis to check on the relationship between inflation and economic growth and even with investment since it can also be influenced by inflation and other variables that affect it.
The Kenyan government should facilitate and fund further research to identify factors that determine the level of inflation in the country; as this is one way through which inflation can be regulated.

Further research on the impact of inflation on other economic variables like on the investment in the country; is very important since investment is one of the major determinants of economic growth

5.6 Conclusions

This study made an empirical analysis of inflation economic growth in Kenya; and concludes that since price stability is the only way through which monetary policy reduces inflation and promotes sustainable growth and development. Efforts should therefore be put to achieve sustainable development in order to accelerate economic growth as well as identifying the threshold growth-inflation level.
REFERENCES


